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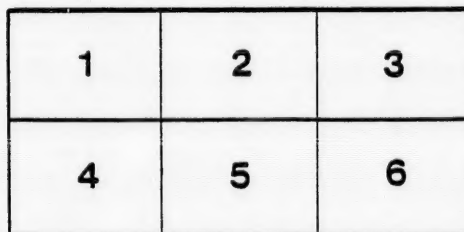
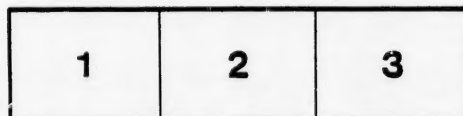
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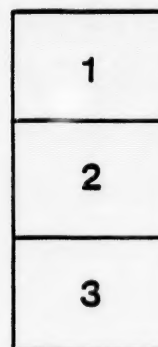
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THE ANCIENT STRAIT AT NIPISSING

BY

F. B. TAYLOR

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THE ANCIENT STRAIT AT NIPISSING

BY F. B. TAYLOR

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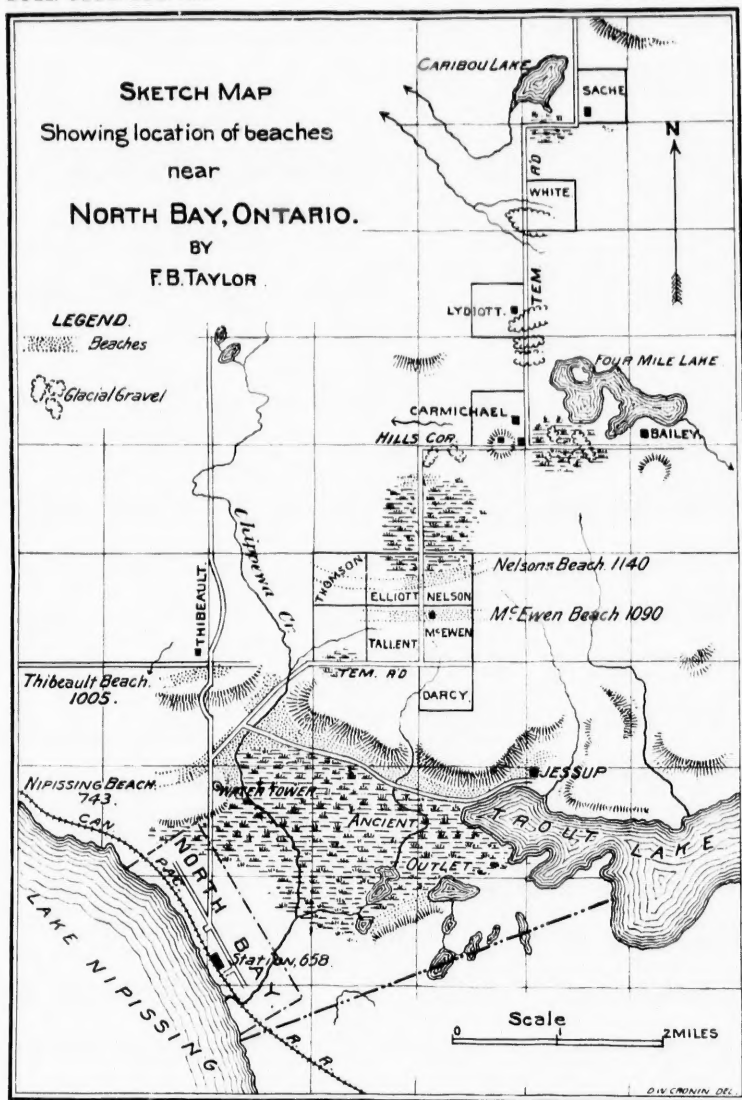
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INTRODUCTION.

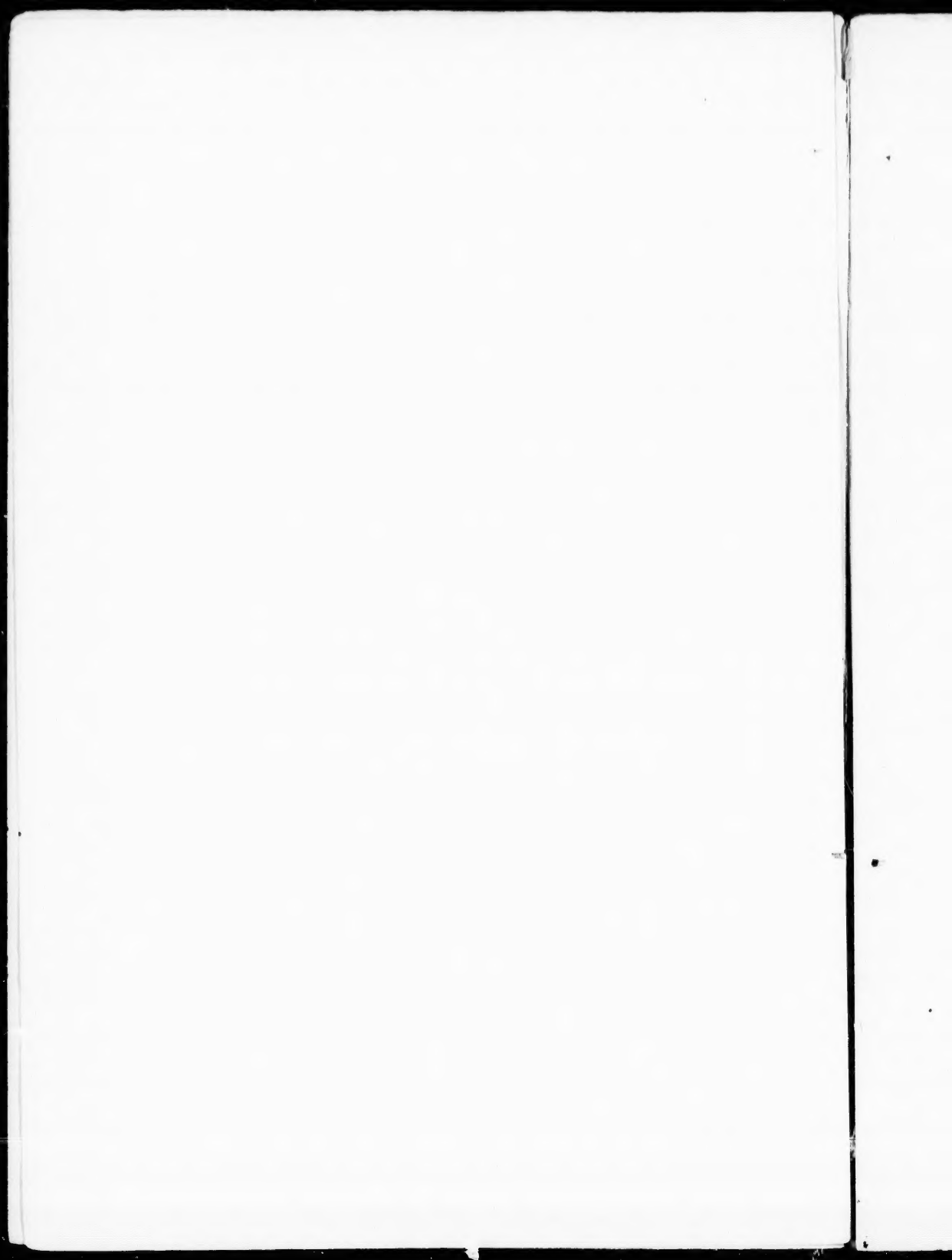
One of the most interesting and significant chapters of modern geologic research in America has been the gradual unfolding of the story of postglacial changes of the Great lakes. Deserted shorelines have been traced with more or less continuity around all their coasts and several abandoned outlets are already well known. It was my privilege recently to visit the site of one of these and bestow some study on its appearance and surroundings. First in August, and again in September of the season just past, I went to North bay, in the Province of Ontario, to see the country in the vicinity of the ancient outlet at lake Nipissing. In August I was accompanied by Dr F. Savary Pearce of Philadelphia. It is the object of this paper to give a short description of what was observed on those occasions. On account of limited time and the roughness of the country it was not possible to make more than a brief reconnaissance, and it was partly because of the indecisive results of the first visit that the second one was made.

The existence formerly of an outlet for the Great lakes at lake Nipissing had been regarded by me as an established fact; but it was still an open question whether the waters of the great postglacial submergence rose above the level of the outlet river. The only information on the subject which had ever come to my knowledge was from a conversation with Mr G. K. Gilbert at Indianapolis, in August, 1890. Mr Gilbert had then just returned from lake Nipissing and had examined the bed of the ancient outlet. He expressed his belief in the existence of the river and added that he thought he saw terraces on the hills back of North bay at an altitude of 200 to 300 feet above the lake, but that he had not examined them closely. This agreed in a general way with an hypothesis which I had entertained for some time previous and according to which I had estimated the probable height of the highest shoreline at lake Nipissing at an altitude of at least 400 feet. To pursue this inquiry was the chief object of my visits.

My measurements were made with an aneroid; but care was taken to determine the weather variation and eliminate it as far as possible. The datum for the localities near North bay was the Canadian Pacific railway station at that place. On the profile of the road this is given as 635 feet above the "Summer level of



SKETCH MAP OF A PORTION OF ONTARIO.



the Saint Lawrence at Montreal." The latter I found by Doctor Spencer's table of altitudes in Canada to be 12 feet above high tide in lake Saint Peter, or 23 feet above mean tide level, making the station at North bay 658 feet above the sea. The level of lake Nipissing is a trifle less than 15 feet below the station, but according to the Canadian Geological Survey * lake Nipissing is 665 feet above sealevel. By the same authority it is stated that levels were run from Trout lake to lake Nipissing, showing the former to be 25 feet above the latter, and that the height of land on the portage from Trout lake to the Riviere a la Vase, which flows into lake Nipissing, is 24½ feet above Trout lake; but I have used the Canadian Pacific railway levels, which would make lake Nipissing about 20 feet lower. I am indebted to Mr John Bourke of North bay for an excellent map of Widdifield township, which contains all the places referred to near North bay. The location of the beaches described will be found on plate 20.

BEACHES.

THE NIPISSING BEACH.

At Mr Jessup's house, on the north side of the west end of Trout lake, a little more than four miles east-northeast from North bay, this shoreline may be seen as a delta-terrace, filling a recess in the hill where a small stream enters. Its front edge is about 50 feet above Trout lake, and its back 10 to 15 feet higher. At this place it is composed mainly of gravel, comparatively fine and free from boulders. From this point westward it continues with the same strong character past Chippewa creek and the Temiscamang road, which is as far as the ground was seen. At the foot of the hill west of Jessups the terrace becomes a narrow shelf close to the lake, and is composed of a mass of well rounded boulders, many of them more than a foot in diameter. For more than half a mile it retains this form, but beyond that it gradually loses its steepness in front and becomes wider and finer in composition. Toward Chippewa creek it widens still more and in a few places low bench ridges of gravel were noticed along its front.

About a mile north of North bay the flats end abruptly against the face of a terrace of bowldery drift. This terrace is a small plateau which projects southward about a mile from the foot of a high hill. It is probably of glacial origin, but it has been largely modified by the later action of waves, and possibly also to some extent by the flowing water of the abandoned outlet river. Its southward front has been eroded away in comparatively recent time, for it is still a steep, fresh bluff. Its eastern slope is more gradual and is covered by a series of well formed beach ridges, which may be seen to good advantage from the Temiscamang road about a quarter of a mile north of the water-tower. The fork of the road north of the tower is on the crest of the plateau, and also upon a gravel beach ridge which extends about half a mile northwest from that point. The altitude of this ridge is about 85 feet above the station, and the Temiscamang road follows it from the fork. The beach at the fork is a little higher than the terrace at Jessups, but not more than the proper difference between a beach and a terrace.

I did not see the slopes at corresponding levels south of the old channel, except what may be seen from the train near Callendar. At that place there is appar-

* As quoted in the "Report of Commission on Forest Preservation and National Park," etcetera, Toronto, 1893, p. 32.

ently a strong shoreline at a level corresponding to that on the north. Mr Bourke, who is familiar with the ground, indicated for me the place of a coarse gravel terrace which he has seen on the south side and which marks approximately the narrowest part of the ancient outlet.

This great shoreline is more strongly developed than any other in that vicinity above or below it, unless it be the highest line, to be mentioned later, and it seems probable that it marks the level of the Great lakes during the era of the active river outlet at Nipissing. Its level at North bay is about 743 feet above mean tide, or 160 feet above lake Huron. There is a strongly accentuated beach like this a little lower, but not widely departing from its level, at many places farther west along the shore of the North channel and the south side of lake Superior. For two spaces of about 45 miles each on the Superior shore I have traced it continuously. Its rise toward lake Nipissing indicates a slight uplift of the land in the vicinity of that lake, which must have taken place since the outlet was abandoned. The existence of this uplift is not surprising, in view of the marked warping of the Ontario highlands farther south.

BEACHES AT HIGHER LEVELS.

Besides the shoreline already described in connection with the ancient river outlet there are well developed beaches at much higher levels on the hills north of North bay. Faint evidences of wave action were seen at various intermediate levels, but I will mention here only those which are well formed and conspicuous as shoreline features.

Thibeault Beach.—Two miles straight north from North bay the road ascends the steep face of Thibeault's hill to an altitude of about 350 feet above the station. Half a mile or more beyond is Mr Thibeault's house, at the corner of the concession line road. Just south of this corner the road crosses a beach which is composed of clean, fine, well-rounded gravel. It extends as a ridge about an eighth of a mile west-southwest from where the road crosses it, and to the east it abuts against stony ground at a slightly higher level. On the east side of the road it has been excavated for ballast, and its composition is shown to be typical fine beach gravel. This beach is about 345 feet above the North bay station, or about 1,005 feet above sealevel.

In passing up the ravine of Chippewa creek on the Temiscamang road deep deposits of rounded gravel were seen which are probably remnants of former deltas of the stream made at successively lower levels as the waters subsided.

† *McEwen Beach.*—About four and a half miles northeast of North bay on the Temiscamang road and about half a mile north of Darcys corner is a beach ridge of gravel and coarse sand. It looks like the edge of a terrace when seen from the lower ground to the south, but on near approach it is seen to be a distinct ridge with a depression behind it. Its composition is disclosed in a cut at the roadside. It is a composite ridge showing two or three lines, but not very distinctly. Its altitude is about 1,090 feet above sealevel. East of the road the ground is well cleared and the house of Mr McEwen is built upon the ridge. This ridge also passes westward through the property of Mr Tallent.

Nelson Beach.—The McEwen beach is much surpassed by another less than half a mile farther north and about 50 feet higher. This is the highest as well as the strongest and best developed beach found on the hills north of lake Nipissing. Its altitude is about 1,140 feet above mean tide. The house and barn of Mr

Nelson are built on it east of the road. It is a broad, composite beach ridge composed of rounded gravel, rather fine, but with some pebbles and a few cobbles. To the south it faces in a series of steps of five to six feet each over the McEwen beach and the flat beyond, which drops at a distance of about two miles by a deep descent to the bed of the ancient river channel. I learned by inquiry that this gravel ridge extends westward through the lands of Messrs Elliott and Thomson and probably eastward also for a considerable distance.

The Nelson beach is in contour with a large swampy tract north of it. On the Temiscamang road this swamp is about a mile wide, but with two or three insular patches of higher ground in it. On the front of the former mainland on the north side of this swamp I found a small amount of washed, rounded gravel, but it only reached up to five or six feet, which is no higher than the top of the Nelson ridge.

THE UNSUBMERGED AREA.

This concludes the sum of the positive evidences observed on the hills north of North bay. Toward the north the country is rough, the clearings in the forest are few, and there are many swampy, almost impassable places; but my investigations did not stop at the Nelson beach. The process of making a reliable determination of the upper limit of postglacial submergence requires the gathering of negative evidences from the higher ground as well as positive evidences from below. On the first excursion on the Temiscamang road we drove north from Nelsons a mile and a quarter to Hills corner, and from there east two miles and a quarter to the farm of Mr Bailey, which is next south of Four Mile lake. Several gravel ridges were seen, but I was unable to recognize the work of waves in any of them. I am quite sure they were all glacial forms. Their positions and surroundings, as well as their forms, were unlike true littoral features. About half a mile east of Hills corner there is a small, short gravel ridge which juts eastward from a drift mass somewhat after the fashion of a wave-built spit. It is composed mainly of good sized pebbles well rounded; but it is in a protected place, and the adjacent slopes at the same level, which are well cleared and easy to see, show no sign of wave action whatever. Again, half a mile east of Carmichaels corner are more fine gravel ridges. They appeared to be in the midst of a swamp, are quite irregular in form, with spurs and hollows, and they rise steeply ten to fifteen feet. I regard them as characteristic glacial forms, and they are so delicate in their structure that they could hardly have escaped modification if the waves had ever touched them. The ground along this road is most of it plentifully covered with bowlders of good size, and they are set in drift composed mainly of clay. At Baileys we were about 110 feet above the Nelson beach. By a rough estimate, without measurement, I concluded that Four Mile lake is somewhat below the level at Nelsons. Mr Bailey told me that his land was almost entirely free from bowlders. South of the road it rises in a smooth hill of almost pure clay drift which would be exposed towards the east and southeast if submerged to the level of the road.

While these negative evidences seemed fairly conclusive, they were not entirely so, for I heard of other large gravel ridges farther north on the Temiscamang road. On the second excursion I went three miles north from Carmichaels corner and half a mile east to the farm of Mr Sache, close to the east side of Caribou lake. One mile north of Carmichaels I found the gravel ridges referred to partly on the land of Mr Lydiott. They are immense irregular ridges about 40 feet high and

with a number of typical kettle holes nearly as deep. The composition was largely coarse. Another mile north, on the land of Mr White, is another gravel deposit somewhat similar and plainly of glacial origin. Near Mr Sache's house the altitude in the road is about 90 feet above the Nelson beach. The surface in that vicinity is hilly and rough and the ground is a heavy bowlder clay. The drainage is westward into Duchesnay creek, which empties into lake Nipissing.

Thus upon both positive and negative evidences of submergence, the Nelson beach was found to be the highest postglacial shoreline on the hills north of North bay.

THE SOUTH SHORE OF THE STRAIT.

On the south side of the Nipissing pass the hills are much farther away, the nearest accessible point at an altitude corresponding with the Nelson beach being at Trout creek, about 28 miles south-southeast from North bay. The highest post-glacial shoreline was located at Sundridge and South river, and lines a little lower were found at Trout creek. The first visit to these localities was made before the first one to North bay, and closed a two weeks' trip along the line of the Northern and Pacific Junction railway. The detailed account of those localities belongs to the record of that trip and will therefore be omitted here.

Well formed beach ridges of fine gravel were found at Sundridge facing south over the wide basin of Stony lake, which was an arm of the expanded waters at the time of the great submergence. The highest is at an altitude of about 1,205 feet above sealevel. At South river a cut terrace 50 to 60 feet above the level of an immense deposit of finely bedded clay and white silt overlain by sand was found at an altitude of about 1,220 feet. These two localities are only about five miles apart and were connected with each other and also with the ancient strait to the north. At Trout creek, 11 miles farther north, the level of the highest line at South river was not reached, but evidences of submergence were seen up to about 1,150 feet above sealevel. The failure to reach the highest line at this place was accidental and affords no just ground for presumption against the inference that a shoreline probably exists there at a slightly higher level than that at South river. The altitudes of these localities are based on the heights of the stations above lake Ontario, as given on the profile of the railroad in the engineer's office at Toronto.

The finding of the highest beach considerably higher on the south side of the Nipissing pass than on the north is rather exceptional among beaches, which almost universally rise northward; but it is not surprising when due account is taken of the very marked eastward component of differential elevation, which is well established by the observations of Dr Spencer farther south.

The ancient strait, as defined by the two highest shorelines described, was about 32 miles wide at the place of observation; but the hills draw nearer to each other toward the east, and the narrowest part of the strait was probably not less than 25 miles wide. Its depth over the low pass between lake Nipissing and Trout lake must have been more than 500 feet.

THE OHNAPING DELTA.

One other locality may be appropriately mentioned in this connection. It is about eight miles east of Cartier, which is on the main line of the Canadian Pacific railway, 125 miles west-northwest from North bay. On the way east I stopped off

at Sudbury for the particular purpose of making the trip to Cartier. From Vermilion river to the summit, three miles east of Cartier, there is an ascent of 496 feet in $14\frac{1}{2}$ miles, and the altitude of Cartier above mean tide is 1,363 feet. I had counted quite confidently on finding the great upper beach somewhere on this slope. On going there I found immense terraces of gravel at several elevations up to about 1,200 feet above sealevel. They are old deltas of the Ohnaping river and the smaller streams which flow into Silver lake. The railway cuts them to splendid advantage for observation and they have been excavated extensively for ballast. The country is very rough, heavily wooded and there are no roads, but the terraces can be seen distinctly from the rear platform of the train. I saw a few sand and gravel ridges near the highest level which closely resembled beaches, but could not be certain as to that. For 40 or 50 feet above the terrace at 1,200 feet there are extensive gravels filling up the stream beds. They are undoubtedly related to the ancient water-level. It seems probable, judging by similar places previously observed, that the highest beach proper is 20 or 30 feet above the level of the massive terrace at 1,200 feet.

Cartier is built upon a level gravel plain which seems to have filled an ancient lake or expanded valley. About a mile to the west against the rough hills are three distinct terraces like steps of perhaps 15 or 20 feet each. I do not know whether these forms are glacial or in what relation, if any, they stand to the great submergence.

ANCIENT NIPISSING ISLAND.

If the highest beaches here described mark approximately the contour of the shoreline of the great submergence, it must have covered a wide area of the surrounding lowlands. Upon the basis of these determinations I have sketched in figure 1 this part of Ontario, showing the location of the strait and the lake country to the north and, also in a rough and only conjectural way, the probable extent of the water in that direction. The interesting region of the northern lakes is still wild and almost unbroken; but the general character of the country is pretty well known. The altitudes of the larger lakes have been determined approximately and canoe routes are followed from one to another. The altitude of Temiscamang lake is given by the Canadian Geological Survey as 612 feet above sealevel. Lake Tamagaming, to the southwest, I did not find, but it is probably not much more than 100 feet higher. Wagaming is given at 862 feet, and Wahnapietaeping still farther southwest at 937 feet. Tamagaming is remarkable for having two outlets,

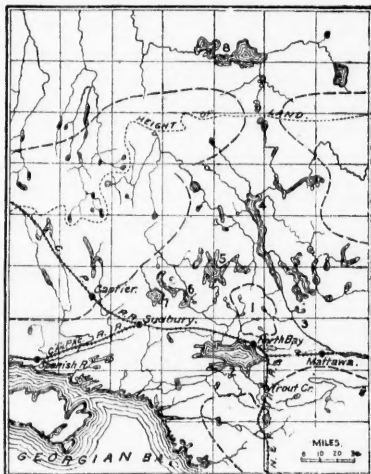


FIGURE 1.—Sketch Map of part of northern Ontario.

Showing, 1, ancient Nipissing island, with the strait to the south of it; 2, lake Nipissing; 3, the Ottawa river; lake Temiscamang; 5, lake Tamagaming; 6, lake Wagaming; 7, lake Wahnapietaeping; lake Abitibi.

one to the north and the other to the south. It is a favorite canoe trip to go down the Mattawa from Trout lake near North bay, up the Ottawa, up the Montreal river a short distance, up the north outlet of lake Tamagaming, from this lake down its southern outlet to Sturgeon river, down this to lake Nipissing and thence back to North bay. The surveys for the James bay extension of the Grand Trunk railway were going on during the past season northward from North bay. From Mr J. C. Bailey, of Toronto, who had charge of the work, I learned much concerning the character of the country, and especially of the region surrounding lake Tamagaming. The divides northeast and south of this lake are not high. To the north of North bay for perhaps 40 to 50 miles the land about the sources of the Little Sturgeon, Antoine and Joeko rivers is high; but considering the low altitude of lake Temiscamang and the others southwestward it seems a pretty safe conjecture that the high tract north of Nipissing strait was a large island, and that it was bounded toward the east by a broad expanse of water overlying the upper Ottawa, toward the north by a wide strait overlying lake Tamagaming, and to the west by an open water surface extending nearly to Cartier. Dr Bell gives the altitude of lake Abittibi as 857 feet and of the pass over the Height of Land between lakes Temiscamang and Abittibi as 957 feet above sealevel.

CONCLUSIONS.

The belief which I ventured to express in a previous paper* has in the main been verified. At their highest level the Great lakes had open connection with waters to the east through a broad strait at Nipissing, and it now seems probable that they had another to the northeast. It is not yet proved that these connections were with the ocean, but I believe the evidence tends more and more strongly toward that conclusion. The glacial hypothesis was plausible and useful, but as exploration has progressed it has been found necessary to put the ice dams farther and farther back, until it now seems fair to say that the burden of proof rests with those who favor them.

In view of these facts, I express again, and with increased confidence, the belief that the Iroquois beach and the highest beaches in the lower Saint Lawrence, Champlain, Hudson and Ottawa valleys, and in the basins of lakes Huron, Michigan and Superior, and also in the valley of the Red river of the North, are all one continuous shoreline of the sea.

FORT WAYNE, INDIANA.

*"The highest Old Shore Line on Mackinac Island," *Am. Jour. Sci.*, 3d series, vol. xliii, March 1892, pp. 216 and 218.

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